

Erosão do Solo: Conceitos e Mecânica

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O Solo é um recurso natural estratégico

A Degradação do Solo no planeta Terra ainda é uma crise mal resolvida

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Science

Soil and Trouble

WHEN PEOPLE INTENSIVELY TILL FIELDS and clear-cut forests, they can damage or destroy topsoil that took centuries to accumulate. Just how vulnerable soils are depends on underlying conditions. Mismanaged soils in wind-swept areas can easily turn into deserts, for example, and saline soils can become salt-encrusted wastelands.

The map shows the main barriers to productive farming, along with erosion risk, derived from climatic and soil conditions. Check out an interactive version of this map appears online at www.sciencemag.org/cgi/content/full/346/6207/931E.

PHYSICAL DEGRADATION
 ▲ CHEMICAL DEGRADATION

Climate Constraints

- High and very high levels of soil degradation per Global Assessment of Soil Degradation (GLASOD)
- Highly erodible by wind or water
- Fresh constraints

Physical Constraints

- High dissolved nutrients
- High soil waterlogging
- Low structural stability
- Low water holding capacity
- Saline soils

Chemical Constraints

- Low organic matter
- High water exchange capacity
- High aluminum
- Cationic exchange capacity
- Low nutrient holding capacity
- Low residual soil nutrient status
- High phosphorus, nitrogen, and organic resources
- High nitrogen or water
- Salinity/alkalinity
- Highly erodible and nutrient scarce

Geographic callouts include: UNITED STATES (Drought of water resources in 1950s led to desertification), CENTRAL & EASTERN EUROPE (Drought in 1990s led to desertification), IRAN (Drought in 1990s led to desertification), KAZAKHSTAN & UZBEKISTAN (Drought in 1990s led to desertification), CHINA (Drought in 1990s led to desertification), WESTERN EUROPE (Drought in 1990s led to desertification), AMAZON (Drought in 1990s led to desertification), SUB-SAHARAN AFRICA (Drought in 1990s led to desertification), AUSTRALIA (Drought in 1990s led to desertification), HIMALAYAS (Drought in 1990s led to desertification), and CHINA (Drought in 1990s led to desertification).

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Global Consequences of Land Use

Jonathan A. Foley,^{1*} Ruth DeFries,² Gregory P. Asner,³ Carol Barford,¹ Gordon Bonan,⁴ Stephen R. Carpenter,⁵ F. Stuart Chapin,⁶ Michael T. Coe,^{1†} Gretchen C. Daily,⁷ Holly K. Gibbs,⁷ Joseph H. Helkowski,¹ Tracey Holloway,¹ Erica A. Howard,¹ Christopher J. Kucharik,¹ Chad Monfreda,¹ Jonathan A. Patz,¹ I. Colin Prentice,⁸ Navin Ramankutty,¹ Peter K. Snyder⁹

22 JULY 2005 VOL 309 SCIENCE www.sciencemag.org

proportion of landscape

stage in land use transition

pre-settlement | frontier | subsistence | intensifying | intensive

natural ecosystems | frontier clearings | subsistence agriculture and small-scale farms | protected/recreational lands | urban areas | intensive agriculture

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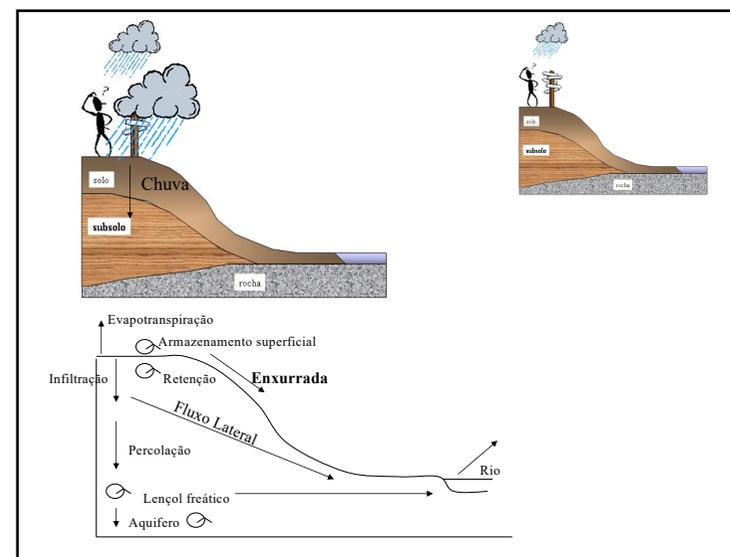
Relatório sobre o Status do Solo no mundo

A **FAO** e o **Painel Técnico Intergovernamental sobre Solos** em 2015 finalizaram o primeiro relatório sobre o Estado do Recurso Solo no mundo:

- A maior parte dos solos no mundo encontram-se numa condição de conservação **razoável, pobre e muito pobre**.
- Globalmente, a **erosão do solo** foi identificada como a maior ameaça, provocando a deterioração da **qualidade da água** em regiões desenvolvidas e a redução da **produtividade agrícola** em muitos países em desenvolvimento.
- A **qualidade da informação sobre solos** para a formulação de políticas deve ser **melhorada** – as avaliações regionais do Relatório sobre o Estado do Recurso Solo no Mundo frequentemente se apoiam em **estudos** da década de **1990** e em dados obtidos nos anos **80 ou antes**.

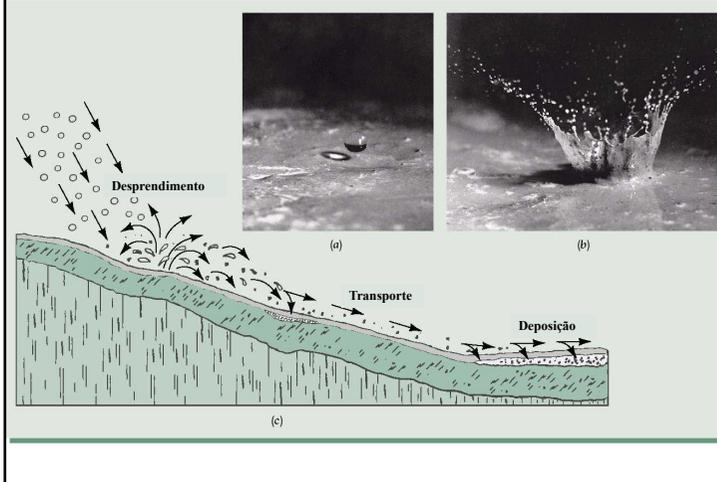


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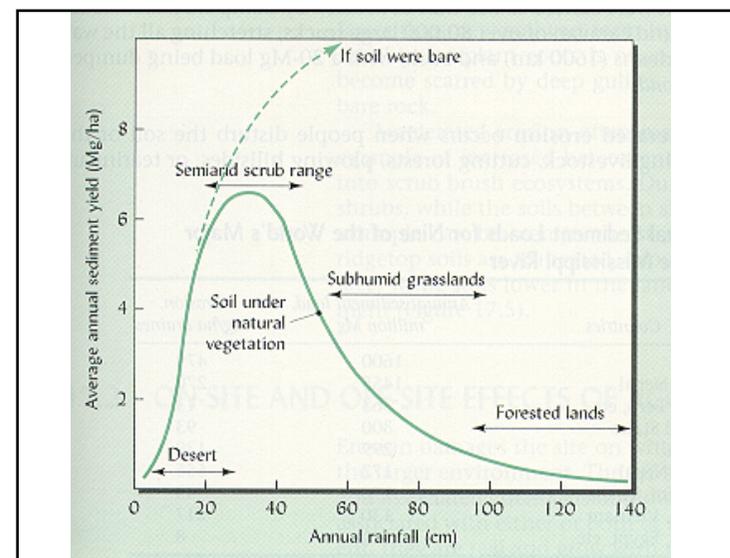


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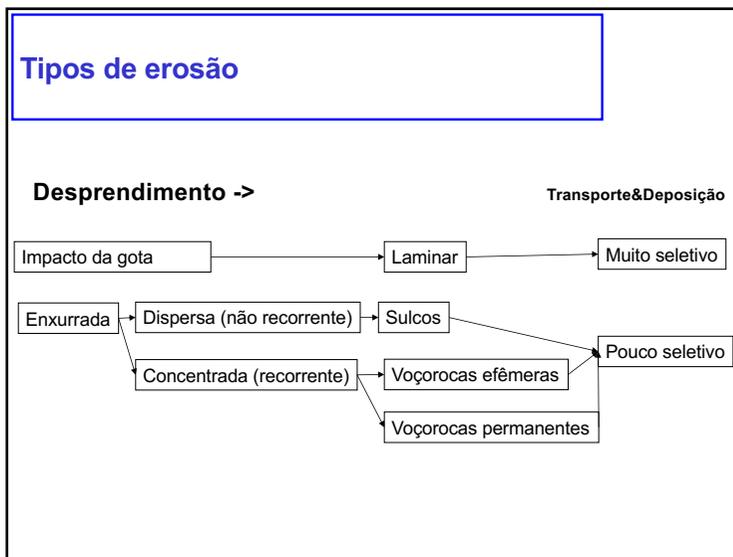
Mecânica da erosão pela água



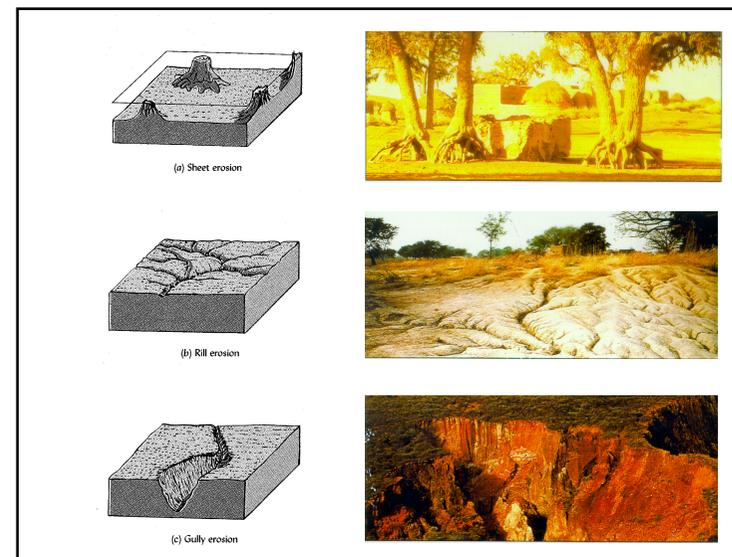
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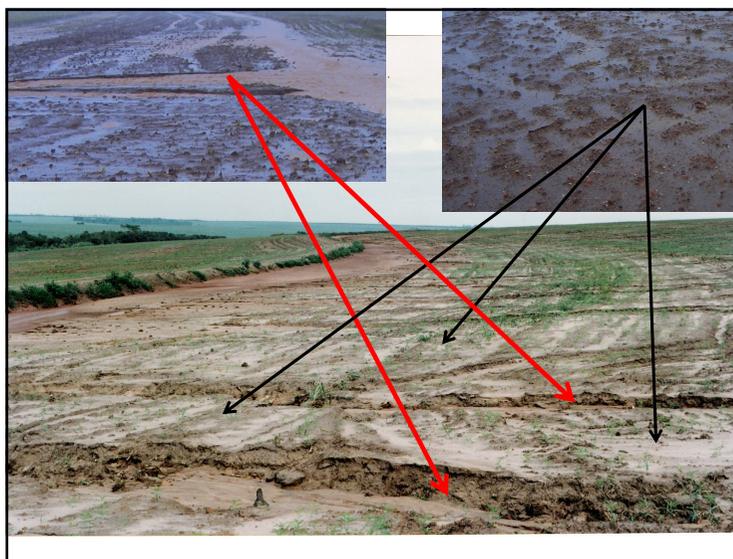
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Impacto da Gota de Chuva

- desprendem partículas de solo no local que sofre impacto;
- transportam, por salpicamento, as partículas desprendidas;
- imprimem energia, em forma de turbulência, à água superficial.

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Energia Cinética e Momento da Gota de Chuva

É muito importante conhecer a força com que a chuva impacta contra o solo.

A energia cinética e o momento são calculadas a partir da massa e da velocidade:

$$Ec = \frac{1}{2}mv^2 \qquad Mom = mv$$

Energia cinética da chuva e da enxurrada:

	Chuva	Enxurrada
Massa	Suponha uma massa de queda da chuva = R	Suponha 25% de enxurrada, e a massa da enxurrada = R/4
Velocidade	Suponha uma velocidade de 8m/s	Suponha a velocidade de escoamento na superfície de 1m/s
Energia Cinética	$1/2 \times R \times (8)^2 = 32R$	$1/2 \times R/4 \times (1)^2 = R/8$

Fonte: Hudson (1973)

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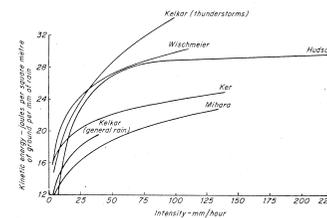


FIGURE 3.9 The relation between kinetic energy of rainfall and intensity. Each curve extends to the highest intensity recorded. The studies were carried out in the following countries: HEMONS—Rhodesia, KULAK—India, KEN—Tanzania, MINAKI—Japan, WISCHMEIER—Central States

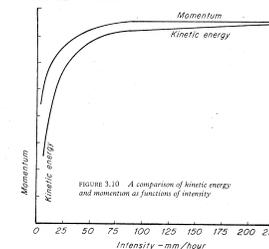


FIGURE 3.10 A comparison of kinetic energy and momentum as functions of intensity

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Tamanho e Velocidade Terminal da Gota de Chuva

Diâmetro da gota de chuva	Velocidade Terminal	Altura da queda com a qual a gota de água adquire 95% da sua velocidade terminal
mm	m/s	m
1	4,0	2,2
2	6,5	5,0
3	8,1	7,2
4	8,8	7,8
5	9,1	7,6
6	9,3	7,2

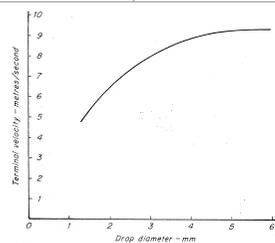


FIGURE 3.8 The terminal velocity of raindrops (data from LAWS 1941)

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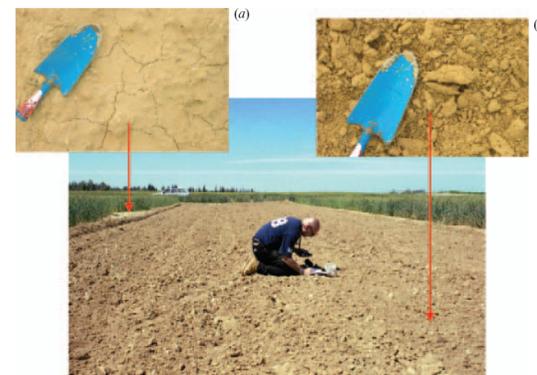
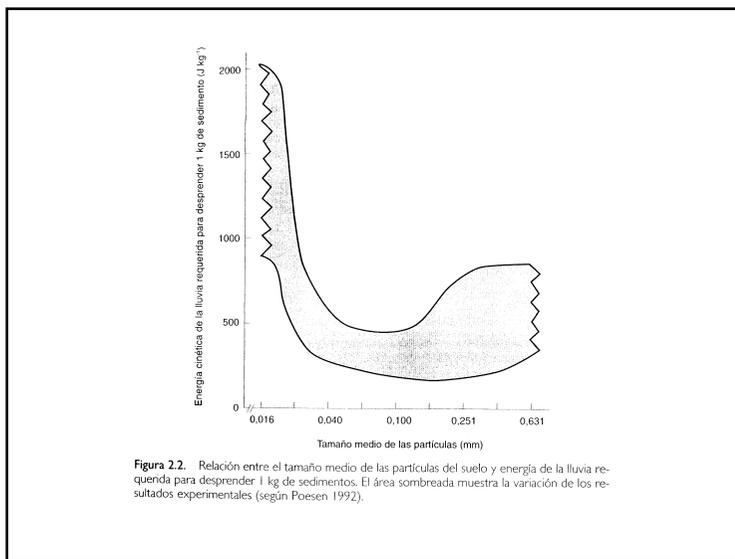


Figure 5. An overview of plot 3 (see figure 3(b)) in its discus (non-crust), and two enlarged images of the (a) crusted and (b) non-crusted soils from a distance of 80cm.

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Raindrop impact phenomena: The rigid case

Impacto da gota no solo

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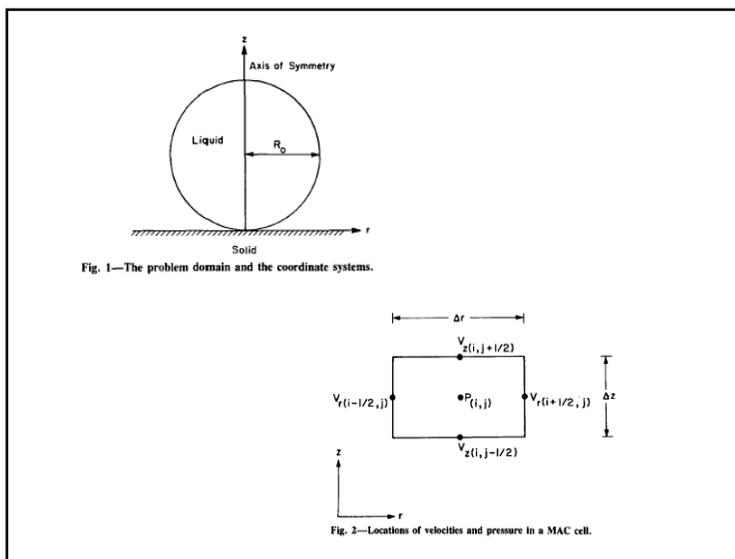
Compressão pelo impacto

Cisalhamento pelo “lateral jetting of water”

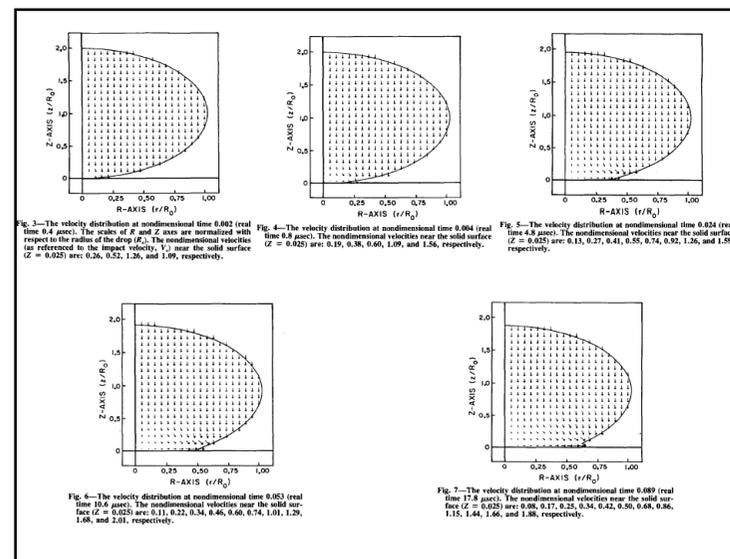
Qual é a magnitude do impacto?

Quais são as velocidades do fluxo lateral?

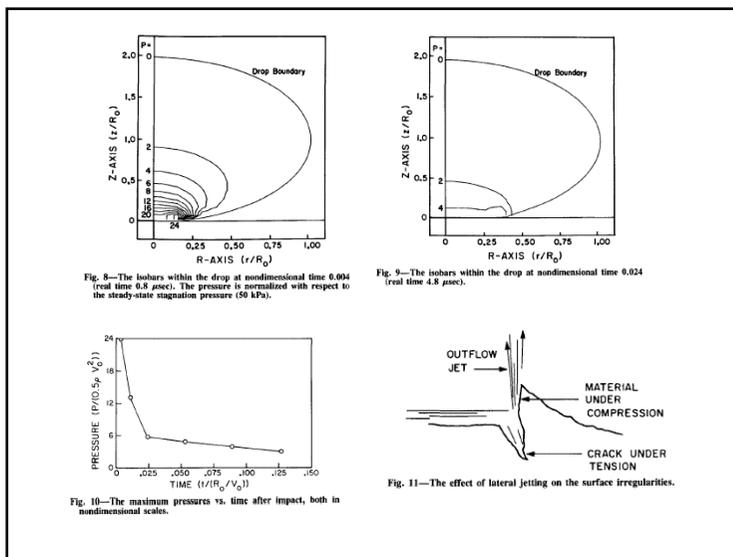
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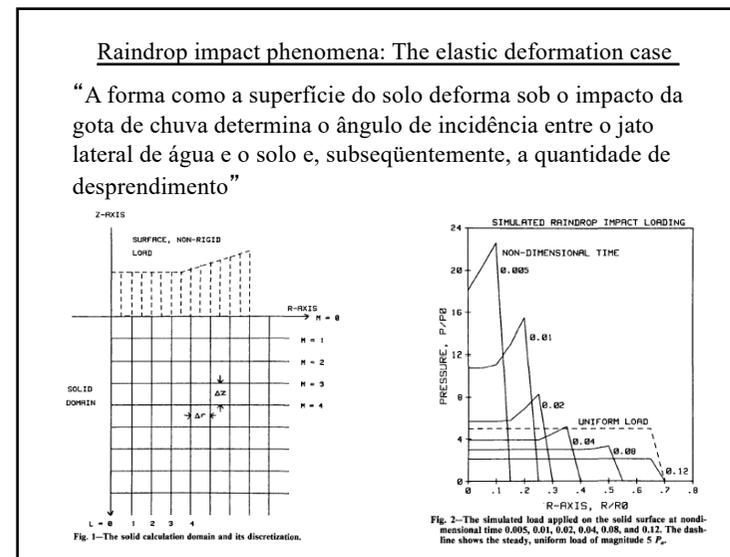
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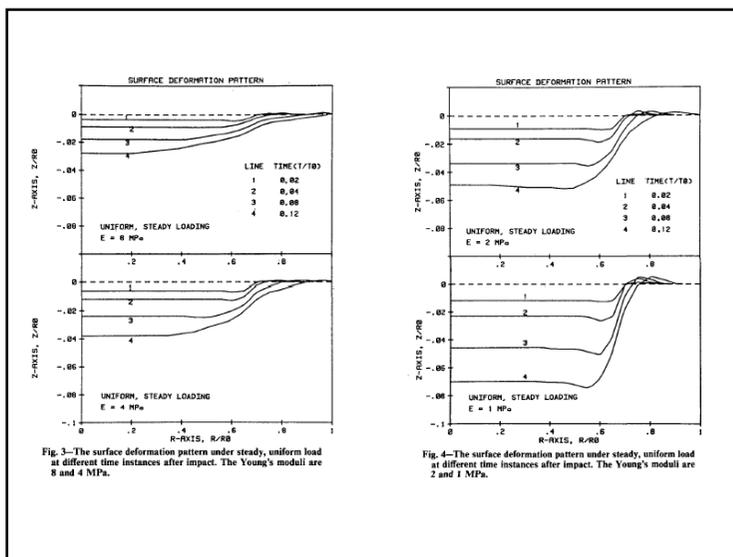
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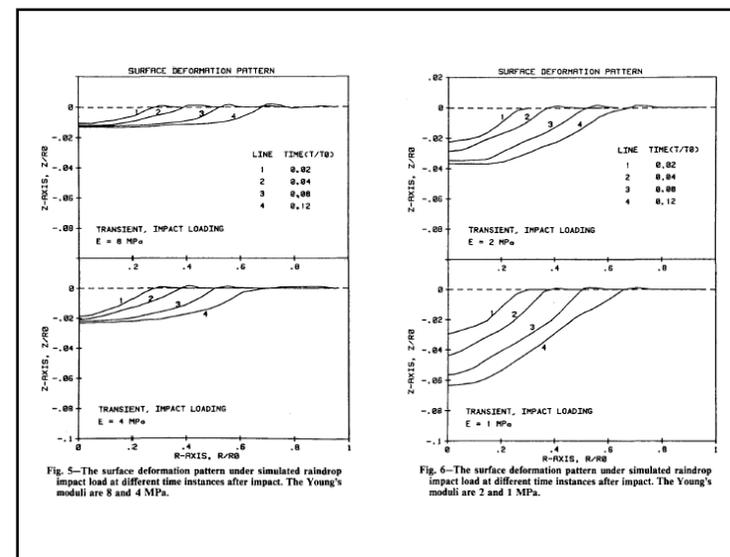
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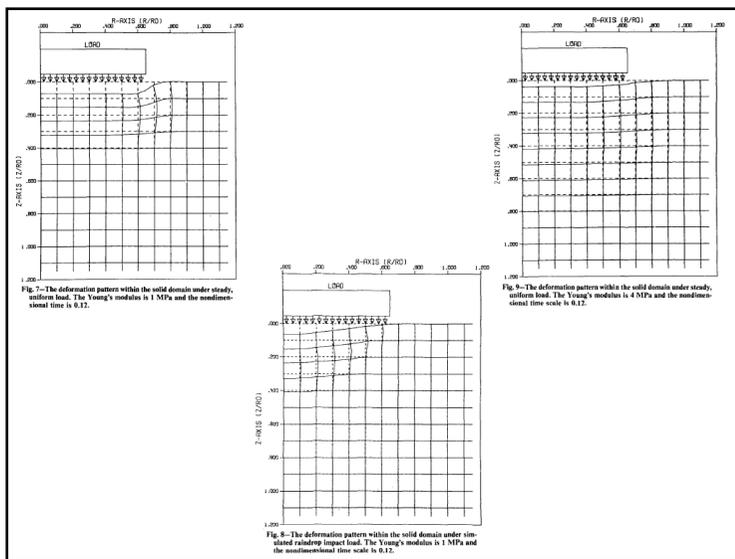
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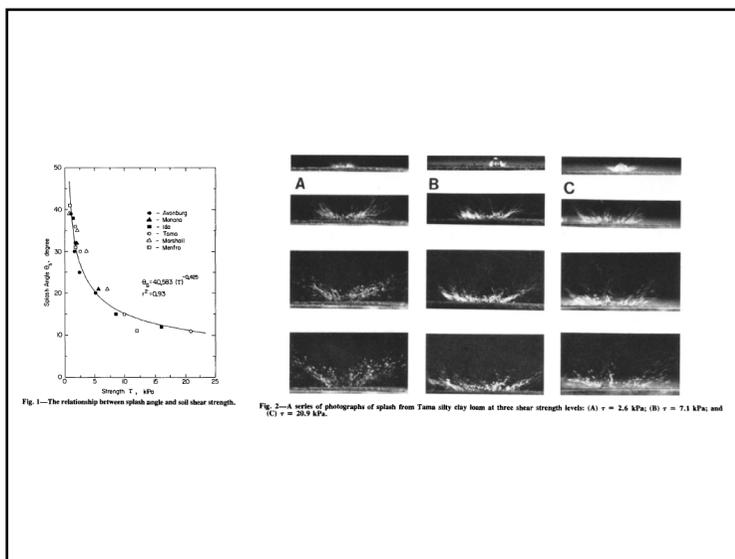
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The Mechanism of Raindrop Splash on Soil Surfaces

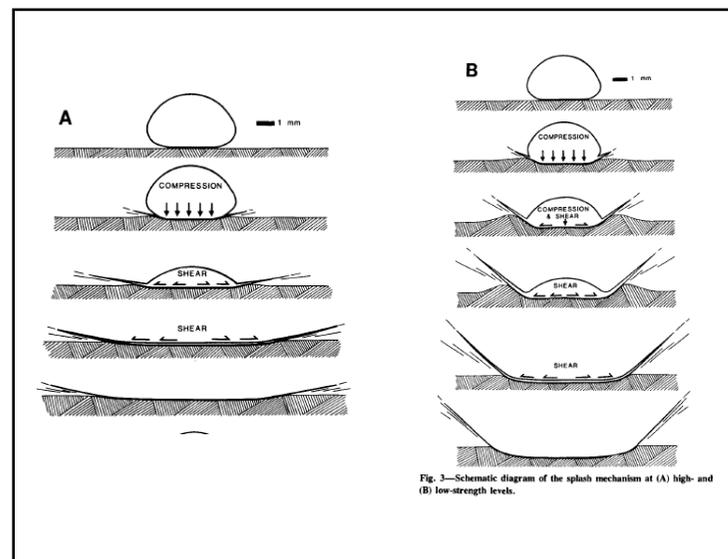
Uso de fotografia de alta velocidade para fotografar salpicamento de gotas de chuva impactando vários solos com potenciais matriciais, densidade e força de cisalhamento diferentes

Fig. 1—Schematic diagram of the raindrop tower.

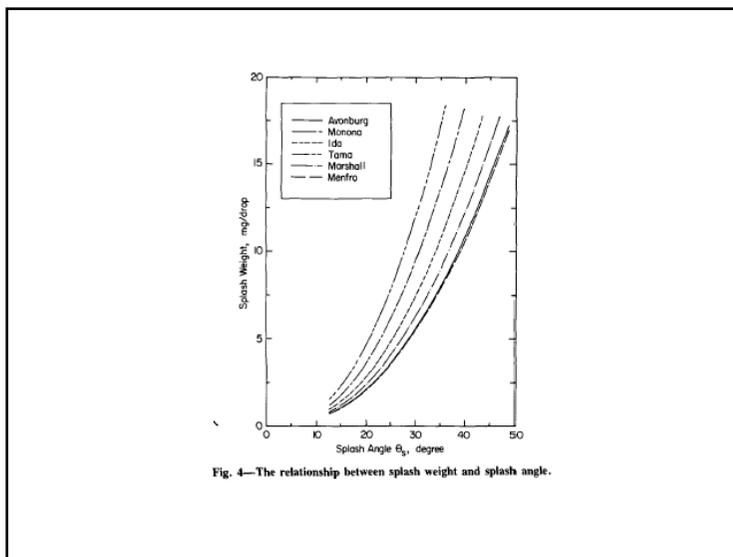
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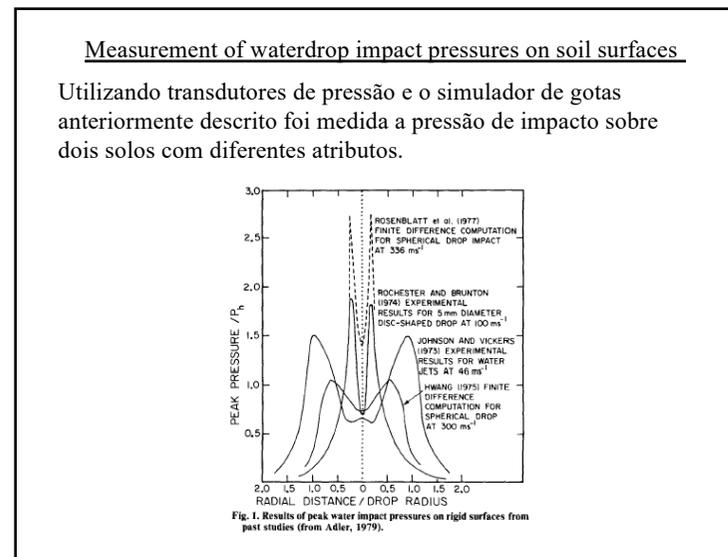
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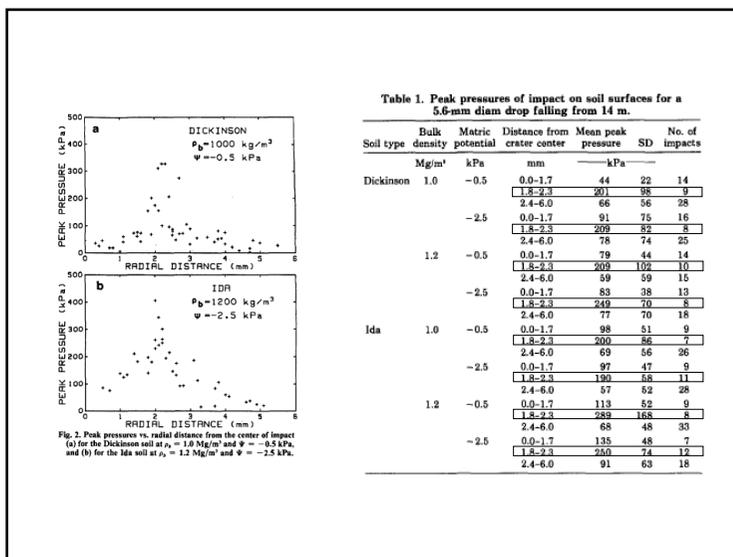
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